RESEARCH NOTES

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EFFECT OF HARVESTING METHODS ON REPRODUCTION IN THE MOUNTAIN ENGELMANN SPRUCE-ALPINE FIR TYPE 1/

by

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In 1944 an experiment to determine the best of three different harvesting methods in the mountain Engelmann spruce-alpine fir forests was started at the Fraser Experimental Forest on the Arapaho National Forest, Colorado. The study consists of a block of four 8-acre plots from which 60 percent of the merchantable volume (10 inches d.b.h. and over) was harvested in the following manner:

PLOT A. -- Alternate-strip clear-cutting.
Fifty percent of the merchantable volume was removed by commercial clear-cutting (to a 10-inch d.b.h. limit) of alternate strips 1 chain wide. An additional 10 percent was harvested by a salvage cutting in the remaining 1-chain strips.

PLOT B. -- Group selection.
Fifty percent of the merchantable volume was removed by commercial clear-cutting of circular groups, 1 chain in diameter, and 10 percent was removed by a salvage cutting in the remaining plot area.

PLOT C. -- Single-tree selection.
Sixty percent of the merchantable volume was harvested by a uniform individual-tree-selection system. This method was common practice in the spruce-fir type at the time the study was designed.

PLOT D. -- Uncut control.

Before logging there was an average of 6,320 seedlings and saplings (trees less than 3.6 inches d.b.h.) per acre on the plots. Logging, which was done with horses, destroyed about 45 percent of this advanced growth. Damage varied directly with the proportion of the area subjected to intensive logging activity. Destruction was most severe under single-tree selection where 100 percent of the area was covered by rather heavy logging operations; less severe under strip clear-cutting where 50 percent of the area was heavily logged; and lightest under group selection where only one-third of the plot was intensively logged.

1/ The mountain spruce-fir type is here distinguished from the mesa spruce-fir type. The mountain type is characterized by a lighter textured soil, less competitive herbaceous undergrowth, and greater ease of regeneration both in the virgin and cut-over stands.

Immediately after logging, an average of 3,476 advanced seedlings and saplings per acre remained on the plots. Even those portions of the plots which were commercially clear-cut supported stands of over 2,500 seedlings and saplings per acre. These provided stocking on over 50 percent of the mil-acre stocking units used in the study. Thus, while logging damage was heavy on a percentage basis, the advanced growth which survived logging was adequate to provide a fair stand of reproduction.

Surveys made in 1949, 5 years after logging, indicated that the reproduction destroyed in logging had been almost completely replaced by subsequent regeneration. The plots supported an average of 5,655 seedlings and saplings per acre, or 89 percent of the number prior to logging. Strip clear-cutting, having regained but 75 percent of the original number of seedlings and saplings, has made the poorest recovery. This can probably be explained by the fact that the strips are laid out in a north-south direction and are, therefore, more disposed to dessication than the other plots. Single-tree selection cutting had recovered 80 percent of its prelogging regeneration while group-selection cutting had exceeded its prelogging numbers by 4 percent. Clear-cut openings in the group-selection cutting plot are so small that very little sunlight strikes the ground within them. Hence, drying is a minor factor. It is anticipated that strip-cutting running in an east-west direction, would result in regeneration more comparable to that achieved under group selection.

Cutting tended to alter and improve the species composition. Prior to logging, fir reproduction, with its greater tolerance, had a five-to-one advantage over the more valuable spruce on plot A, three-to-one on plot B, and was equal to spruce on plot C where the exposure is a little more severe. However, subsequent reproduction has been predominantly spruce and lodgepole pine. As a result, 5 years after logging, the combination of spruce and pine exceeded fir on the single-tree-selection plot, was equal to fir on the strip-clear-cutting plot, and was only slightly less than fir on the group-selection plot. It appears, then, that the less tolerant spruce and pine have been given the greatest advantage under the single-tree selection system. On all plots, 16 percent of the mil-acre stocking was subsequent spruce or pine, while only 6 percent was subsequent fir.

Results on this rather limited study indicate that:

1. Under any of the three harvesting methods, advanced reproduction surviving logging is sufficient to provide a well-stocked stand. Composition of such a stand, however, is predominantly alpine fir.

2. Natural regeneration after cutting is rapid, resulting in nearly full stocking 5 years after logging. Reproduction is most complete under group-selection cutting, where exposure of the soil to solar radiation is relatively low, and least complete in the clear-cut strips where exposure is greatest.

3. In all methods of harvesting used, subsequent reproduction tends toward the more desirable, less tolerant Engelmann spruce and lodgepole pine.

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